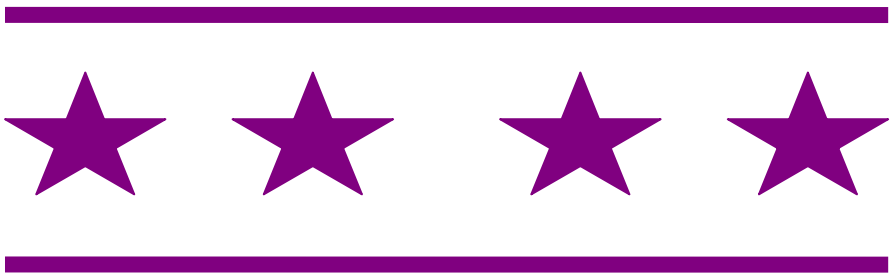
TDC



Theater Deployable Communications

Baseline Requirements Document

for the
Large Voice Module
LVM (v2.1)

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REVISION TABLE

Revision	Description of Changes

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1. SCOPE

This requirements document establishes the performance, manufacture and test requirements for the TDC ICAP Large Voice Module.

2. APPLICABLE DOCUMENTS

To the extent specified herein, the following documents of latest current issue on the date of this appendix, form a part of this appendix.

Document Number	Title
ANSI Std. T1.102	American National Standard for Telecommunications - Digital Hierarchy - Electrical Interfaces
ANSI Std. T1.107	American National Standard for Telecommunications - Digital Hierarchy-Formats Specifications
ATT Pub. 43801	Digital Channel Bank Requirements and Objectives
ANSI T1.601-1992	American National Standard for Telecommunications - Minimal Set of Bearer Services for the ISDN U Interface
ANSI T1.603-1990	American National Standard for Telecommunications - Minimal Set of Bearer Services for the ISDN Primary Rate Interface
ANSI TIA/EIA-470-B 1997	Telephone Terminal Equipment
EIA-232-E	Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange (Rates to 20 kbps)
ITU Q.310 -- Q.326	[Signaling System R1, Various Recommendations]
ITU Q.920	ISDN User-Network Interface - Data Link Layer, General Aspect - Digital Subscriber Signaling System No.1
ITU Q.921	ISDN User-Network Interface - Data Link Layer Specification - Digital Subscriber Signaling System No.1
ITU Q.930	ISDN User-Network Interface - Layer 3, General Aspects - Digital Subscriber Signaling System No.1
ITU Q.931	ISDN User-Network Interface -Layer 3 Specification - Digital Subscriber Signaling System No.1
ITU X.25	Interface Between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for Terminals Operating in the Packet Mode and Connected to Public Data Networks by Dedicated Circuit
MIL-STD-810F	Environmental Test Methods
REDCOM 008421-V50, -EV50*	IGX•C ISDN Gateway Exchange User's Manual
REDCOM 008836-001, -E001*	Feature Addendum, Host Control Interface for IGX
REDCOM 008837-002, E002*	Feature Addendum, Basic for the IGX

*Delivered with Module

3. REQUIREMENTS

3.1 Module Definition

The Large Voice Module (LVM) provides access for analog and digital voice users and PRI/DS1 connectivity to the Switch Circuit Network ICAP backbone. The Large Voice Module can be configured to provide all the functions of the Legacy PPT/Voice Module. Some of the standard and configurable functions are:

- User Access for:
  - Analog (POTS)
  - Digital ISDN-BRIs
  - KY-68 Interface
  - Secure push-to-talk (PTT) radio
  - Analog FXO (foreign exchange office) trunks
  - E&M trunks
  - Analog Trunk programmable single frequency (SF) signaling to connect to TRI TAC circuit switches and/or commercial SF trunks.
- Backbone Connectivity for:
  - ISDN-PRI Trunk
  - T-1 Trunk
  - E-1 Trunk

The Large Voice Module application in TDC ICAP is presented graphically in Figure 1. The standard configurations are shown as bold and configurable functions are shown as gray.

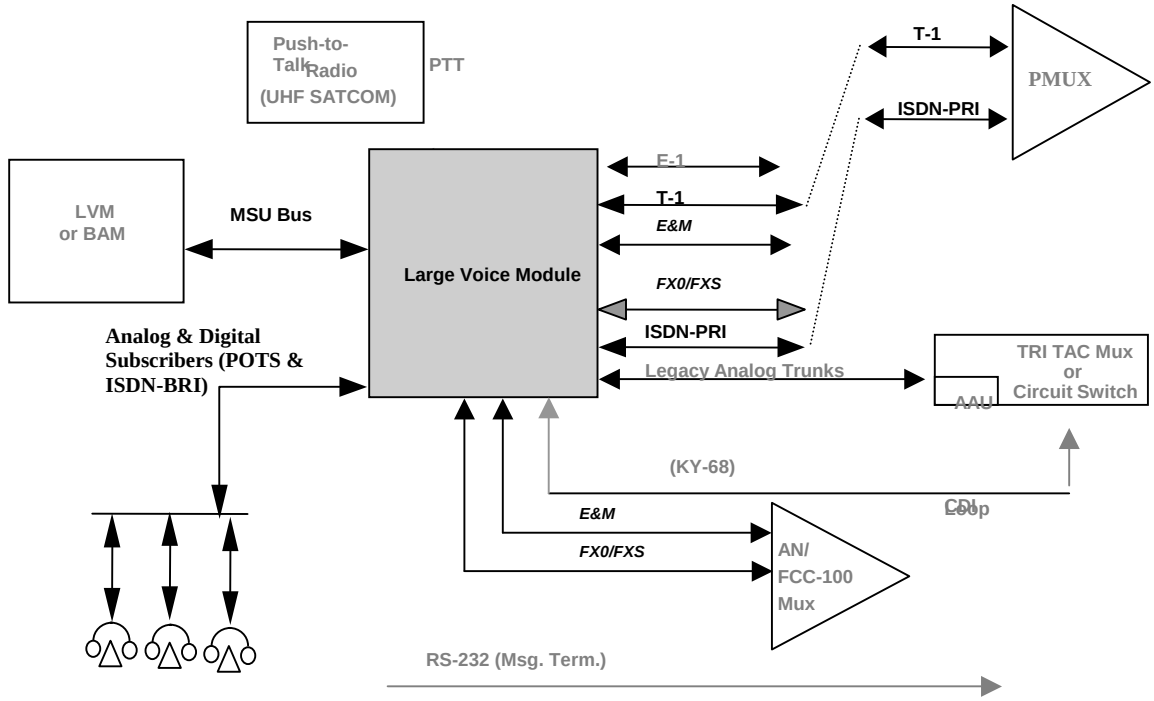


Figure 1: Large Voice Module Application in TDC-ICAP

Figure 2 shows the Large Voice Module internal and external interconnections. Detailed characteristics for each function are in section 3.2.

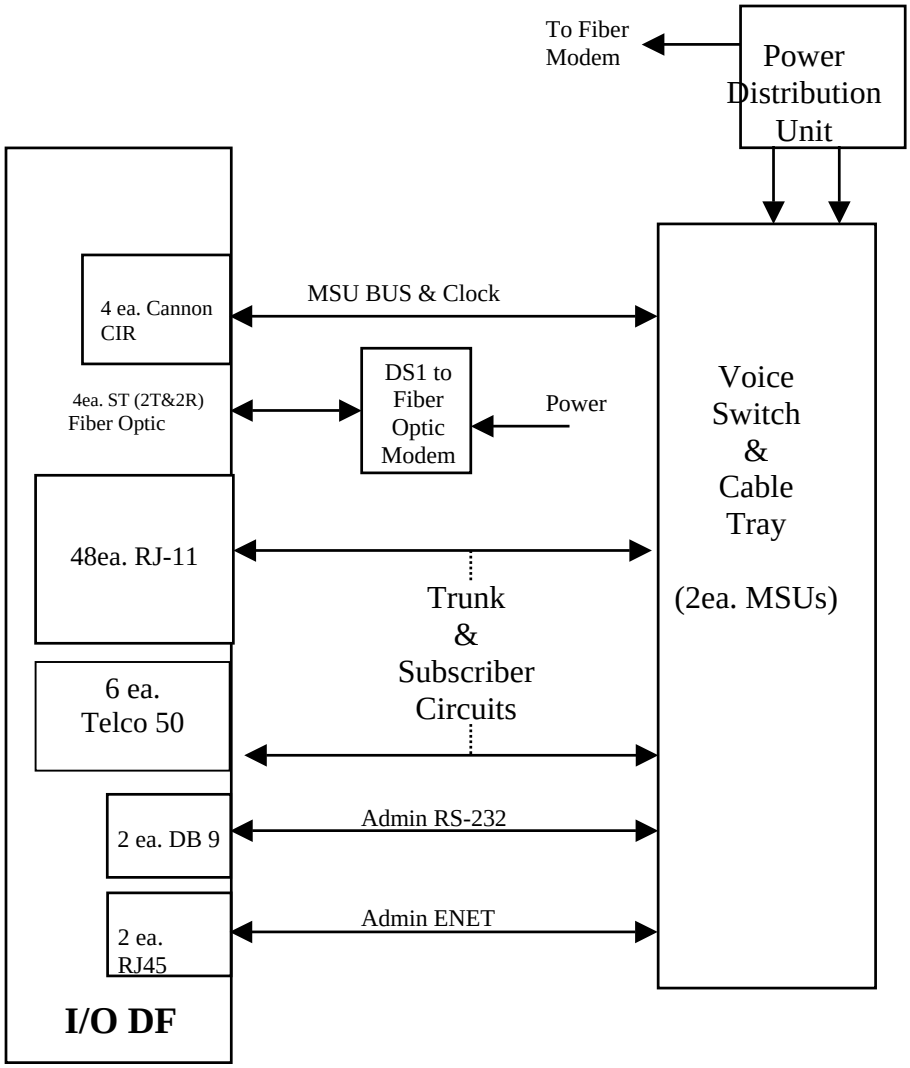


Figure 2: LVM Internal Functional Block Diagram

3.2 Performance Requirements

3.2.1 Electrical Interface Requirements (External)

Access to the Large Voice Module is through the module's Distribution Frames (DF). The DFs are internally wired to provide all the required connections, except the input power. The input power connection is at the power distribution unit. The access ports on the DFs include the number and type of external interfaces presented in Table 1.

Table 1: LVM External Interface Characteristics

Signal Name	#	Connector	Input/ Output	Primary Interface	Electrical Characteristics (See Section 2 "Applicable Documents")
Prime Power	1	IEC 320 C20 Receptacle	I	Local power source	3-wire Single Phase 120/240 VAC; 50/60 Hz.
PRI/DS1	2	ST (T/R)	I/O	LVM or BAM	ANSI T1.603-1990
Switch Bus	2	Cannon CIR 20R	I/O	BAM or another LVM	Circuit switch proprietary.
Clock Sync	2	Cannon CIR	I/O	BAM or another LVM	Circuit switch proprietary.
Remote Voice Connectors	6	Telco-50	I/O	Remote DF	ANSI TIA/EIA-470-B 1997, ANSI T1.601-1992: 24 ea. 2-wire analog or digital subscriber lines
Voice User access	48	RJ-11 (Zone)	I/O	Analog & digital User access	ANSI TIA/EIA-470B 1997,ANSI T1.601-1992: 2 & 4 wire analog and/or digital voice access
Voice Switch Administration 10BaseT Enet	2	RJ-45	I/O	Personal Computer	EIA-802.3
Voice Switch Administration RS-232	2	DB-9F	I/O	VT-100 type terminal	EIA-232

3.2.1.1 Prime Power

The Large Voice Module is designed to operate from 100 to 240 VAC, –50 - 60 Hz, single-phase, 3-wire power. The Large Voice Module includes an internal power distribution unit to minimize line transients and EMI. The prime power connector is an IEC 320- C20 receptacle. Separate switches are provided on the power distribution unit for each prime component; Voice Switch, DS1 to Fiber Optic Modem, etc.

3.2.1.2 DS1Backbone

The ISDN-PRI backbone signals are 1.544 Mbps serial data and can be formatted as either ISDN PRI or T-1 trunks. The two backbone connections are made on the distribution frame with four type-ST, fiber optic connector jacks (two transmits and two receives). Two additional DS1/PRI are accessible either directly at the cards or thought the RJ-11s via zone connections.

- When configured as ISDN PRI digital trunk connections the DS1s has the following features and characteristics:
  - Electrical interface is the same as T-1 with B8ZS line coding.
  - 23 ISDN B-channels mapped into 23 DS0 T-1 channels.
  - 64 Kbps D-channel mapped into 24th DS0 T-1 channel.
  - Digital Subscriber System No. 1 D-Channel signaling.
  - Access procedures as defined in ITU recommendations Q.920, Q.921, Q.930, Q.931 and X.25.
- When configured as T-1 digital trunk connections the DS1 has the following features and characteristics:
  - Electrical characteristics in accordance with ANSI Standard T-1.102
  - Programmable at the circuit switch to support both super frame (SF) and extended super frame (ESF) in accordance with ANSI Standard T1.107.
  - Programmable at the circuit switch to support both AMI (alternate mark inversion) and B8ZS (bipolar 8-zero suppression) line codes.
  - Line signaling in accordance with Table 2.

Table 2: T-1 Signaling Protocols Supported

Signaling Type	Standard (See Section 2 "Applicable Documents")
E & M (R1)	ITU (CCITT) Q.310 -- Q.326
FX Loop Start	ATT Publication 43801 Section C
FX Ground Start	ATT Publication 43801 Section C

3.2.1.3 Switch Bus

The Voice Switch Bus connectors are Cannon CIR 020R jacks with the pinouts being proprietary. A cable suitable to interconnect two LVMs or a LVM and BAM are supplied with each LVM.

3.2.1.4 Clock Sync

The Clock Sync pinouts are proprietary. The Clock Sync is normally connected to the Voice Switch Bus IN connector. A cable suitable to interconnect two LVMs or a LVM and a BAM are supplied with each LVM.

3.2.1.5 Remote Voice Connectors

The six Remote Voice connectors are Telco-50 pin receptacles. The Remote Voice connectors provide up to 24 each 2-wire analog and/or digital connections (POTS, ISDN-BRI, etc.). Pin assignments are shown in the following table.

Table 3: Telco-50 Remote Voice Connectors

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	Ring	26	Tip	13	Ring	38	Tip
2	Ring	27	Tip	14	Ring	39	Tip
3	Ring	28	Tip	15	Ring	40	Tip
4	Ring	29	Tip	16	Ring	41	Tip
5	Ring	30	Tip	17	Ring	42	Tip
6	Ring	31	Tip	18	Ring	43	Tip
7	Ring	32	Tip	19	Ring	44	Tip
8	Ring	33	Tip	20	Ring	45	Tip
9	Ring	34	Tip	21	Ring	46	Tip
10	Ring	35	Tip	22	Ring	47	Tip
11	Ring	36	Tip	23	Ring	48	Tip
12	Ring	37	Tip	24	Ring	49	Tip
				25		50	

3.2.1.6 Voice User Access

The 48 Voice User Access connectors are RJ-11s and in the basic configuration are wired via the zone connectors to provide two-wire analog subscriber ports that have the following features and characteristics:

- Analog Subscriber
  (a) 2-Wire loop start interface compatible with ANSI TIA/EIA-470-B 1997 instruments.
  (b) Support for dual tone multi-frequency (DTMF) or pulse (rotary) dialing in accordance with ANSI TIA/EIA-470-B 1997.
  (c) RJ-11 connectors -- Ring (pin 3); Tip (pin 4); Zone connectors A, B, C and D.

3.2.1.7 Voice Switch Administration RS-232

The Voice Switch Administration ports are in accordance with the DB-9F RS-232 standards pin assignments as shown in the following table, using a VT100 Emulator (9600 bps, No Parity, 8 Data Bits, 1 Stop Bit):

Table 4: Voice Switch Administration RS-232

Pin	Signal	Pin	Signal	Pin	Signal
1	not used *	4	not used *	7	Request to Send
2	Received Data	5	Signal Ground	8	Clear to Send
3	Transmitted Data	6	not used *	9	not used

pins 1,4 and 6 are tied together at the Interface Panel

3.2.1.8 Voice Switch Administration 10BaseT Ethernet

The 10BaseT input ports are in accordance with the eight-wire ANSI/IEEE Std 802.3 10BaseT Standards. The connectors are RJ 45 Modular Jacks. Pin assignments are as shown in the table below.

Table 5: Voice Switch Administration 10BaseT Ethernet

Pin	Signal	Pin	Signal	Pin	Signal
1	TD+	4	Not used	7	Not used
2	TD-	5	Not used	8	Not used
3	RD+	6	RD-		

3.2.2 Electrical Interfaces Requirements (Internal)

Internal module interconnections and cable diagrams are provided in Section 6. The documentation shows the internal wiring of the major module components and the details of each major cable assembly internal to the module distribution frame.

3.2.3 Functional Requirements

3.2.3.1 Basic Configuration

The LVM is a flexible, scaleable and configurable module, which performs Switched Circuit Network functions (Figure 1). The LVM includes a two-shelf circuit switch that implements a private branch exchange (PBX). The LVM provides four ISDN-PRI, two via fiber optic at the I/O DF and two either via RJ-11s at the I/O DF or via DB-9s at the trunk card. The PRI s can be interconnected to the network hub or to another network node. The basic circuit switch configuration; i.e., no optional circuit cards; provides service for up to twenty-four 2-wire analog, eight ISDN-BRI subscribers, and 4 ISDN-PRI trunk connections (Figure 3). The circuit switch is a REDCOM IGX•C Exchange.

The installer may customize the switch by adding additional line replaceable units (circuit cards) for increased subscriber access and switch functionality. The circuit switch provides the features in Table 6.

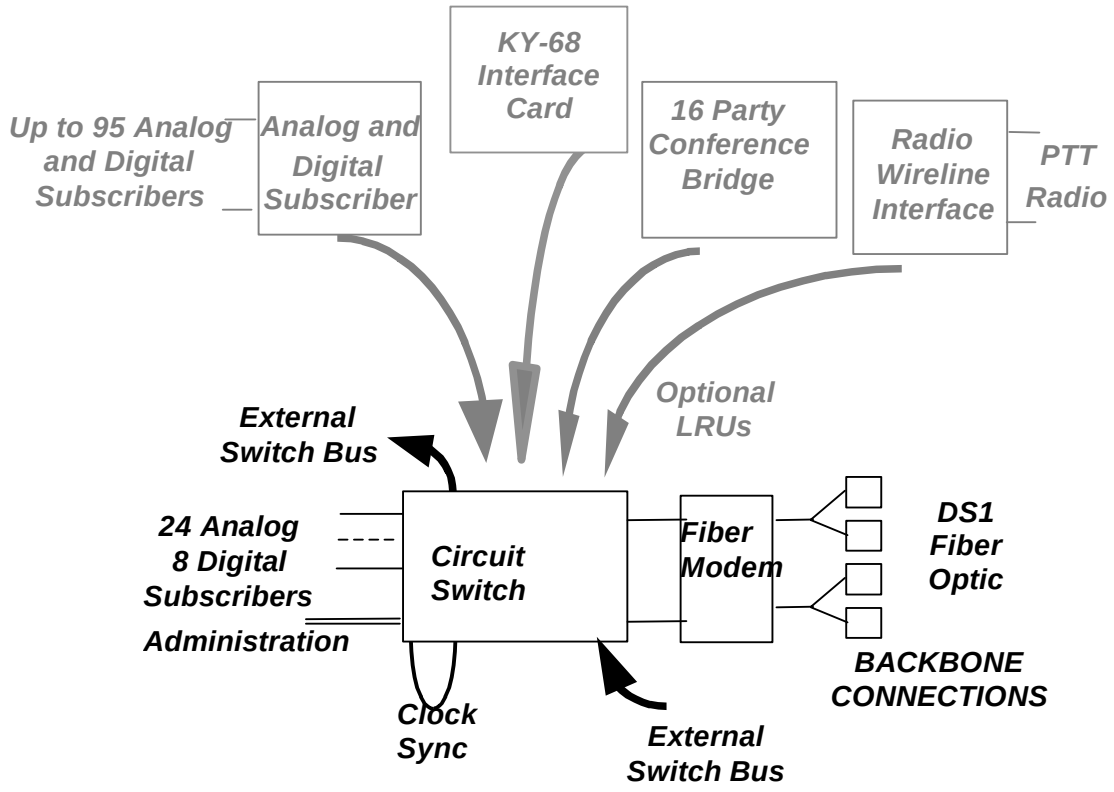


Figure 3: Functions and Options

External circuit switch backplane bus connections are provided so that multiple LVMs (up to a maximum of 4 units) may be connected together to form a single voice circuit switch. These connections permit additional SCN subscribers to be added as a mission grows.

Primary Lightning protection is external to the module for safety.

3.2.3.1.1 Local Subscriber Access

The LVM, in its basic configuration, provides access to the Circuit Switch for 24 local telephone subscribers via 2-wire analog circuits, for POTS (WECO 2500) and compatible products such as Faxes, modems and STU IIIs, and 8 ISDN-BRI "S" digital subscribers, i.e. digital phones and video teleconference units.

Table 6: Voice Switch Features

AUTOVON	Multi Level Precedence and Preemption (MLPP) & PRIORITY FEATURES-provides for processing emergency calls. There are six levels of emergency override.
SITE DOCS/PSR	SITE DOCS/V-LIST-provides the ability to execute the Site Office Records program available on a PCMCIA card. This program will automatically generate IGX system

	information including details on the following: Hardware Configuration, Dialing Plan, Trunks, Lines, and System Tables.
TOLL RESTRICTION	TOLL RESTRICTION FEATURE- provides the capability to restrict originating lines and trunks from accessing specified trunks, and to restrict the digits that they may dial on those trunks.
CO MF	MF SIGNALLING FEATURE-provides the ability for the switch to interpret Central Office Multi-Frequency signaling. The MF Sender/Receiver card is needed for this feature to work.
CUSTOM	ROSMI CUSTOM FEATURE- provides the ability for the switch to interface to the KY-68 Interface card.
HOST	HOST COMPUTER CONTROL (CTI) FEATURE- provides user access to the IGX Host Control Interface. This allows control of switching functions through an external host computer.
BOOK	Creates a phonebook (i.e. a database) of PBX users.
BASIC	Basic Program Language
CHAIN	Conference Chaining
LAW CONVERSION	IGATE
CLUSTER	Multi Cluster Feature
International	International Feature
ISDN	ISDN Features

3.2.3.1.2 Voice Switch Administration

The LVM provides the capability for management of the voice switch through a local lap top computer via the Voice Switch Admin connector at the module's I/O DF. Management of the following functions is provided:

a) Configuration
b) Health and Status
c) Control
d) Downloading statistical data

3.2.3.1.3 Circuit Switch Interconnection

The Circuit Switch is configured with external backplane connections to enable multiple switches to be interconnected to form a larger switch with "single switch" functionality. Two switches are included in the LVM. When a "single switch" is formed, only one administration connection is required.

3.2.3.1.4 Fiber Optic Modem

The fiber optic modem converts the bi-directional ISDN PRI trunks to an optical waveform.

3.2.3.2 Configuration Options

In addition to the basic functions and features the installer may customize the switch by modifying the card complement to provide the additional functions and features. Some of the customized interfaces are listed below:

- In conjunction with the KY-68 Interface Card access to 2 each KY-68s per card
- Additional users - 2-wire analog and digital BRI "S"
- Push to Talk (PTT) - Radio wireline Interface
- 16 party conferencing
- E&M – 2 & 4 wire Type 1
- T1, E1 Trunks
- etc.*

*See REDCOM Manual for a more complete listing of the interface and feature options.

The configuration cannot violate the basic configuration rules of the REDCOM IGX•C for the 96 time slots per switch.

3.2.3.2.1 Configuration Kits

The following kits are available to provide additional capabilities to the LVM.

- **Echo Cancellation Kit** – provides external voice circuit echo cancellation for T1 and E1 circuits.
- **International Kit** – provides E1 trunk and support cards for the REDCOM switch preloaded with software features activated, to support interconnections to E1 circuits.
- **Local Base Interface Kit** – provides for interconnectivity with local PBX systems via LSRD/GSRD trunk and E&M trunk 4-wire boards.
- **Radio Interface Kit** – provides LST-5 UHF radio interface cards for the REDCOM switch.
- **Subscriber Extension Kit** – provides the capability to remotely distribute voice circuits from the voice modules.
- **Subscriber Loop Kit** – provides additional 2-wire POTS analog and ISDN-BRI S digital interface cards.
- **T1 Trunk** – provides increased T1/ISDN-PRI trunk capability for the REDCOM switch.
- **TRI-TAC Interface Kit** – provides SF Trunk circuits to interface with TRI-TAC services, such as TTC-39, SB-3865 circuit switches.
- **DSVT Kit** - provides the capability for 4 each KY-68s per card
- **Lightning Protection Kit**

Many of the system level and maintenance kits can be used for LVM module troubleshooting and cable repair. These kits include:

- **Fireberd Analyzer Kit** – Contains the Fireberd 6000 and interfaces for circuit testing.
- **Cable Maintenance Kit** – Contains Fiber Optic Time Domain Reflectometer, HP Digital Average Power Meter, Cable Tester, Digital Multimeter, Oscilloscope, RS530 and Breakout Box.
- **Voice/Data Cable Kit** – Contains Category 5 Twisted Pair materials to make 10/100 BaseT cables (RJ11 and RJ45) with label package.
- **Fiber Cable Kit** – Contains tactical 1.5 K m of fiber cable, SC/ST connectors and fiber termination tool kit.
- **Circuit Extension Kit** – Contains Campus Rex T1/E1, T1/E1 Fiber line driver and CV-2048 Modem.
- **Laptop Computer Kit** – Contains Laptop Computer w/ CD-ROM, Portable Ethernet Sniffer w/ software.
- **Small UPS Kit** – Provides protection and backup (650VA) of prime power circuits.
- **Large UPS Kit** – Provides protection and backup (1500VA) of prime power circuits.

3.2.4 Physical Characteristics

3.2.4.1 Transit Case

The Large Voice Module shall be housed in a 13U man-transportable container (transit case), approximately 22.5”(W) x34.5”(D) x27.3”(H). The transit cases are designed to stack on top of and mechanically interlock to like cases. The transit cases with their covers in place are designed to protect the electronic equipment inside from direct exposure to environmental conditions; e.g., rain, snow, ice, dust, etc., likely to be encountered during world wide military transit.

3.2.4.2 Weight

As a goal, the Large Voice Module, including all internally carried cables, does not exceed 107 Kg/240 lb.

3.2.4.3 Storage Space

The Large Voice Module transit case includes storage pouches within its covers to contain cables, manuals, etc. that must be transported and used with the module.

3.2.4.4 Marking

See TDC ICAP Standards Document for required markings.

3.2.5 Cables and Accessories

The Large Voice Module includes the cables and terminators listed in Table 7, stored within its covers. Strain relief and cable management hardware are provided with the module.

Table 7: Cables and Terminators Included with LVM

Function	Color Code	QTY	Description
Power	N/R	1	IEC 320 female (or equivalent) to NEMA-5P.
Backbone	N/R	2	Multimode fiber optic; 2 fibers; ST to ST.
Admin	N/R	1	DB 9 Plug to DB 9 Jack pin-to- pin
E1 Bus Terminator	N/R	1	Cannon CIR 020R plug Bus Terminator
E2 Bus Terminator	N/R	1	Cannon CIR 020R plug Bus Terminator
Terminator G2	N/R	1	Cannon CIR plug Clock Sync Terminator
Cable Assembly	N/R	1	CLK IN to CLK OUT
Cable Assembly	N/R	1	Bus In to Bus Out

3.2.6 Reliability

The Large Voice Module with its standard complement of LRUs, shall have a mean time between failure (MTBF) commensurate with similar commercial equipment in its class. The actual MTBF for the major components are shown in Table 8. Where reliability data is not available for the vendor, this is indicated.

Table 8: MTBF of Major Components

Components	MTBF
IGX•C Configured for LVM	10,200 hr. (Estimated)

3.2.7 Maintainability

Maintainability characteristics are part of the selection criteria for all hardware. Ease of maintenance, such as accessibility to Line Replaceable Units, fault detection / isolation software capability, and fault annunciation are considered. The module is capable of operating 24 hours per day, seven (7) days a week.

3.2.7.1 Mean Time Between Preventive Maintenance [MTBPM]

The MTBPM is 30 days and consists of checking and cleaning any filter, and inspecting the cable for any cuts, etc.

3.2.8 Environmental Conditions

3.2.8.1 Temperature

The temperature characteristics for the major equipment components are shown in Table 9.

Table 9: Module Temperature Characteristics

Equipment	Temperature (°C)	
	Operating	Non-operating
IGX•C Configured for LVM	0 to 50	Not Available

3.2.8.2 Humidity

The relative humidity characteristics for the major equipment components are shown in Table 10.

Table 10: Module Humidity Characteristics

Equipment	Humidity Non-condensing
IGX•C Configured for LVM	5 to 95%

3.2.8.3 Altitude

The altitude characteristics for the major equipment components are shown in Table 11.

Table 11: Module Altitude Characteristics

Equipment	Altitude	
	Operating	Non-operating
IGX•C Configured for LVM	Not Available	Not Available

3.2.8.4 Sand and Dust

During storage and transport, the module shall be protected when exposed to sand and dust in accordance with the best commercial practices for close proximity to operating aircraft. During operation with covers removed, the module shall withstand sand and dust in accordance with the best commercial practices for natural conditions.

3.2.8.5 Shock

The module equipment rack is equipped with rubber shock isolation mounts and is protected from shocks induced during handling, setup and teardown. Modules and components can operate without degradation following exposure to the non-operating shock environment described by Method 516.5, Procedure VI (Bench Handling) of MIL-STD-810F.

3.2.8.6 Vibration

The module is equipped with rubber shock isolation mounts so that the module can withstand the vibration encountered while being transported by commercial and military airlift, sealift and vehicular (over unimproved roads) systems.

3.3 Design and Construction

3.3.1 Material Parts and Processes

This module shall be built to good commercial practices. Mechanical and electrical interchangeability shall exist between like systems, subsystems, assemblies, subassemblies and replaceable parts.

3.3.2 Safety

The Large Voice Module shall not present a safety, fire or health hazard to personnel.

3.3.2.1 Electrical Safety

The LVM is designed to eliminate the hazard to personnel of inadvertent lethal voltage contact. All electrical conductors carrying voltages in excess of 70 volts are insulated to prevent contact or covered by a protective barrier. All removable protective barriers are interlocked to automatically disconnect power behind the barrier upon removal or clearly marked with a warning label that indicates the voltage potential that will be encountered behind the barrier. If warning labels are used, the warning labels are visible after the cover has been removed.

For telephony interfaces, such as tip and ring, which will occasionally have ringing voltage in excess of 70 volts, Telephone Industry Commercial hardware is acceptable.

3.3.2.2 Mechanical Safety

All sharp surfaces have protective covers or other suitable features to minimize injury where personnel are likely to be exposed to such surfaces.

3.4 Logistics

The module accommodates a two level maintenance concept: organizational (Air Force personnel) and depot (contractor personnel). Removal and replacement of an LRU is defined at the organizational level and any needed repair of the LRU is defined at the depot level. Any special tests or support equipment required to effect removal or replacement of an LRU at the organizational level are provided as part of the module. No more than two persons are required to remove or replace an LRU.

An LRU is defined as the lowest element of the module which can be isolated to be faulty through inspection; built-in test; technical manuals; TDC-ICAP system performance; spares

substitution; or other diagnostic aid approved by the Government for organizational level maintenance, exclusive of expendables such as fuses, lamps and LEDs.

4. QUALITY ASSURANCE PROVISIONS

4.1 General

The quality assurance program includes tests and other evaluations to the extent specified herein. The quality assurance program is designed to verify the electrical, mechanical and functional characteristics of each module. The purpose is to ensure that each module complies with or performs better than the requirements specified herein.

4.2 Responsibility for Inspection

Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements and may use his own or any other facilities suitable for the performance of the inspection requirements. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to the prescribed requirements.

4.3 Product Qualification Test (PQT)

Inspections, analyses, demonstrations and tests were used to verify compliance of Section 3 of this specification on the initial prototype module.

4.4 Production Acceptance Test (PAT)

Each Large Voice Module delivered to the Government undergoes an Acceptance Test Procedure (ATP) as identified in Table 12. The acceptance test verifies that the module interfaces are operating properly prior to delivery to the Government.

4.5 Verification Cross Reference Matrix (VCRM)

Table 12 provides a list of each Section 3 requirement and the verification method to be used. The following paragraphs define the codes employed in the VCRM. Unless otherwise noted, where more than one verification method is shown, one method or a combination of methods may be used to show compliance.

4.5.1 Not Required (N/R)

This method indicates that verification is not required because the paragraph is a title, heading, general introductory paragraph or statement of a goal and contains no “shall” or “must” statements.

4.5.2 Inspection

Inspection is a method of verification of the module performance or characteristics by examination of the equipment or associated documentation. Inspections are conducted with the use of inspection tools, measurement devices, visual means and comparison. Most inspections apply to verification of requirements associated with physical characteristics such as size, weight, appearance, adherence to specified standards and engineering practices, quality design, and construction supported with quality documentation. Inspections also include the auditing of manufacturer's data that verifies the performance of non-developmental items that comprise the TDC ICAP module. Inspections may occur during any assembly stage of the unit under test.

4.5.3 Analysis

Analysis is a method of verification through technical evaluation of calculations, computations, models, analytical solutions, use of studies, reduced data, and/or representative data to determine that the item conforms to the specified requirements.

4.5.4 Demonstration

Demonstration is a method of verification whereby the properties, characteristics and parameters of the item are determined by observation alone and without the use of instrumentation for quantitative measurements. This method is used when a requirement does not contain a specific numerical parameter, which must be measured. Demonstrations may occur during verification of a unit under test at any assembly stage. Pass/fail criteria are simple yes/no indications of functional performance since no quantitative values are specified.

4.5.5 Test

Test is a method to verify that a specified requirement is met by thoroughly exercising the applicable item under specified conditions and by using the appropriate instrumentation in accordance with test procedures. This method requires the use of laboratory equipment, simulators, or services to verify compliance to the specified requirements. This method is used when it is practicable to make direct or indirect measurement of a specified numerical parameter to verify compliance with a requirement. Tests may occur during verification of a unit at any assembly stage. Actual measured values are recorded, and pass/fail is determined by comparing the measured value with the specified value. Measurement accuracy shall be precise enough to ensure that the measured value is within the specified tolerance.

5. PREPARATION FOR DELIVERY

Each module shall be packaged for shipment and the package marked in accordance with the requirements of the contract under which the module is ordered.

Table 12: Verification Cross Reference Matrix

		Verification Method					
Paragraph	**Title**	**PQT**					**PAT**
		N/R	**Inspect**	**Analysis**	**Demo**	**Test**	**Test**
3.	REQUIREMENTS	X					
3.1	Module Definition	X					
3.2	Performance Requirements	X					
3.2.1	Electrical Interface Requirements (External)		X				
3.2.1.1	Prime Power		X			X	
3.2.1.2	DS1 Backbone		X				X
3.2.1.3	Switch Bus		X				X
3.2.1.4	Clock Sync		X				X
3.2.1.5	Remote Voice Connectors		X				X
3.2.1.6	Voice User Access		X				X
3.2.1.7	Admin		X				X
3.2.2	Electrical Interfaces Requirements (Internal)	X					
3.2.3	Functional Requirements	X					
3.2.3.1	Basic Configuration	X					
3.2.3.1.1	Local Subscriber Access	X					
3.2.3.1.2	Voice Switch Administration	X					
3.2.3.1.3	Circuit Switch Interconnection	X					
3.2.3.1.4	Fiber Optic Modem	X					
3.2.3.2	Configuration Options	X					
3.2.3.2.1	Configuration Kits	X					
3.2.4	Physical Characteristics	X					
3.2.4.1	Transit Case		X				
3.2.4.2	Weight		X			X	
3.2.4.3	Storage Space		X				
3.2.4.5	Marking		X				X
3.2.5	Cables and Accessories		X				X
3.2.6	Reliability			X			
3.2.7	Maintainability			X			
3.2.7.1	Mean Time Between Preventive Maintenance [MTBPM]			X			
3.2.8	Environmental Conditions	X					
3.2.8.1	Temperature					X	
3.2.8.2	Humidity		X				
3.2.8.3	Altitude		X	X			
3.2.8.4	Sand and Dust		X	X			
3.2.8.5	Shock					X	
3.2.8.6	Vibration					X	
3.3	Design and Construction	X					
3.3.1	Materials Parts and Processes		X				X
3.3.2	Safety			X			
3.3.2.1	Electrical Safety		X	X			X
3.2.2.2	Mechanical Safety		X				X
3.4	Logistics		X	X			

6. BASELINE CONFIGURATION

6.1 Equipment

Table 13: Equipment Listing

Device	MFG	Part Number	Description	Qty
Circuit Switch	REDCOM	IGX•C Standard Shelf	Circuit switch single shelf	2
Software	REDCOM	5.1.6 -TDC	VERSION B050AR1P6	2
Software	REDCOM	AUTOVON	MLPP & Priority Feature	2
Software	REDCOM	Toll Restriction	Toll Restriction Feature	2
Software	REDCOM	CO MF	MF Signaling Feature	2
Software	REDCOM	CUSTOM	ROSMI Custom Feature	2
Software	REDCOM	HOST	Host Computer Control (CTI) Feature	2
Software	REDCOM	PSR	Print Site Records Feature	1
Software	REDCOM	Book	Phonebook	1
Software	REDCOM	Basic	Basic Program Language	2
Software	REDCOM	Chain	Conference Chaining	2
Software	REDCOM	Law Conversion	IGATE	2
Software	REDCOM	Cluster	Multi Cluster Feature	2
Software	REDCOM	International	International Feature	2
Software	REDCOM	ISDN	ISDN Features	2
Timeslot Interchange	REDCOM	MA0689-001	Voice matrix	2
Cable	REDCOM	CA9079-T08	Cable Assembly F CLK to Bus In (stored in pouch)	1
Cable	REDCOM	CA9079-T3A	Cable Assembly E1 Bus Terminator (stored in pouch)	1
Cable	REDCOM	CA9079-T3B	Cable Assembly E2 Bus Terminator (stored in pouch)	1
Cable	REDCOM	CA9079-T5B	Cable Terminator G2 (5 Pin) Clock Sync (stored in pouch)	1
Cable	REDCOM	CA9079-240	Cable Assembly Bus In to Bus Out (stored in pouch)	1
Cable	REDCOM	CA9079-140	Cable Assembly CLK In to CLK Out (stored in pouch)	1
MSU Controller	REDCOM	MK0640-017	Supervisor and Control Bd. Set	2
Ring Generator	REDCOM	MK0060-005	Switch Ring Generator	2
Line Circuit Board	REDCOM	MK0653-113	8 Circuit Expand Line Bd.	3
DS-1 Board	REDCOM	MK0292-003	TRK DS-1 2 Board Set	4
MF Sender/ Receiver Board	REDCOM	MK0308-101	MF Sender/Receiver Bd. 2 CKT.	1
MTI Board	REDCOM	MK0463-101	MTI User Config BD	2
CLK SYNC Board	REDCOM	MK0473-163	Universal CLK Sync Perm SW/OVR	1
ISDN BRI S Bd.	REDCOM	MK0531-322	ISDN S Board, 4 ckts or lines/card	2
Cable	REDCOM	CA0490-101	Internal MPU Cable	1
Cable	REDCOM	SC0483-001	Internal TSI Cable	1
Power Distribution Unit	Marway	411355	Power Distribution Unit	1
Cable Mgmt	Ortronics	OR60400199	Bend Limiting Strain Relief Bar	1
Connector	REDCOM	1RFBCP0001	Bulkhead Coupler (fiber optic ST)	4
Fiber Optic Modem	S. I. Tech	2890-2R-ASP-1	Dual T1 Fiber Optic Modem	1

Device	MFG	Part Number	Description	Qty
Case	ECS Composites	11961	Transit Case – 13U Case	1
(W2) Cable	REDCOM	CH9079-P36	Power Cable MSU 0	1
(W3) Cable	REDCOM	CH9079-P36	Power Cable MSU 1	1
(W5) Cable	REDCOM	90FB020101	Optic T1 Voice Backbone Cable (0)	1
(W6) Cable	REDCOM	90FB020101	Optic T1 Voice Backbone Cable (1)	1
(W8) Cable	REDCOM	CA9079-304	RS-232 Switch Admin Cable MSU 0	1
(W9) Cable	REDCOM	CA9079-313	RS-232 Switch Admin Cable MSU 1	1
(W11) Cable	REDCOM	CH9079-311	Remote Zone Cable Shelf 0 (1 –12) And DS-1/0	1
(W12) Cable	REDCOM	CH9079-309	Remote Zone Cable Shelf 0 (13-24)	1
(W13) Cable	REDCOM	CH9079-312	Remote Zone Cable Shelf 1 (1-12) And DS-1/1	1
(W14) Cable	REDCOM	CH9079-310	Remote Zone Cable Shelf 1 (13-24)	1
(W17) Cable	REDCOM	SC9079-305	ENET Switch Admin Cable MSU 0	1
(W18) Cable	REDCOM	SC9079-308	ENET Switch Admin Cable MSU 1	1
Cable	REDCOM	90DB9FMX10	Computer Admin Cable	1
Cable	REDCOM	CA9079-A12	Conv cable 9 pin Female to 9 pin Male	6
Cable	REDCOM	CA9079-B12	Conv cable 15 pin Male to 9 pin Male	4
Cable	REDCOM	CA9082-D12	Conv cable 25 pin Female to 9 pin Male	2
(W19) Cable	REDCOM	SC9079-048	REDCOM proprietary Clock Out Cable	1
(W20) Cable	REDCOM	SC9079-148	REDCOM proprietary Clock In Cable	1
(W21) Cable	REDCOM	SH9079-720	REDCOM proprietary Bus Out Cable	1
(W22) Cable	REDCOM	SH9079-840	REDCOM proprietary Bus In Cable	1
(W23) Cable	REDCOM	SC0483-001	REDCOM proprietary TSI Bus Cable	1
(W24) Cable	REDCOM	CA0490-101	REDCOM proprietary MPU Bus Cable	1

6.2 Elevation Drawings

Figure 4 shows the front elevation of the Large Voice Module.

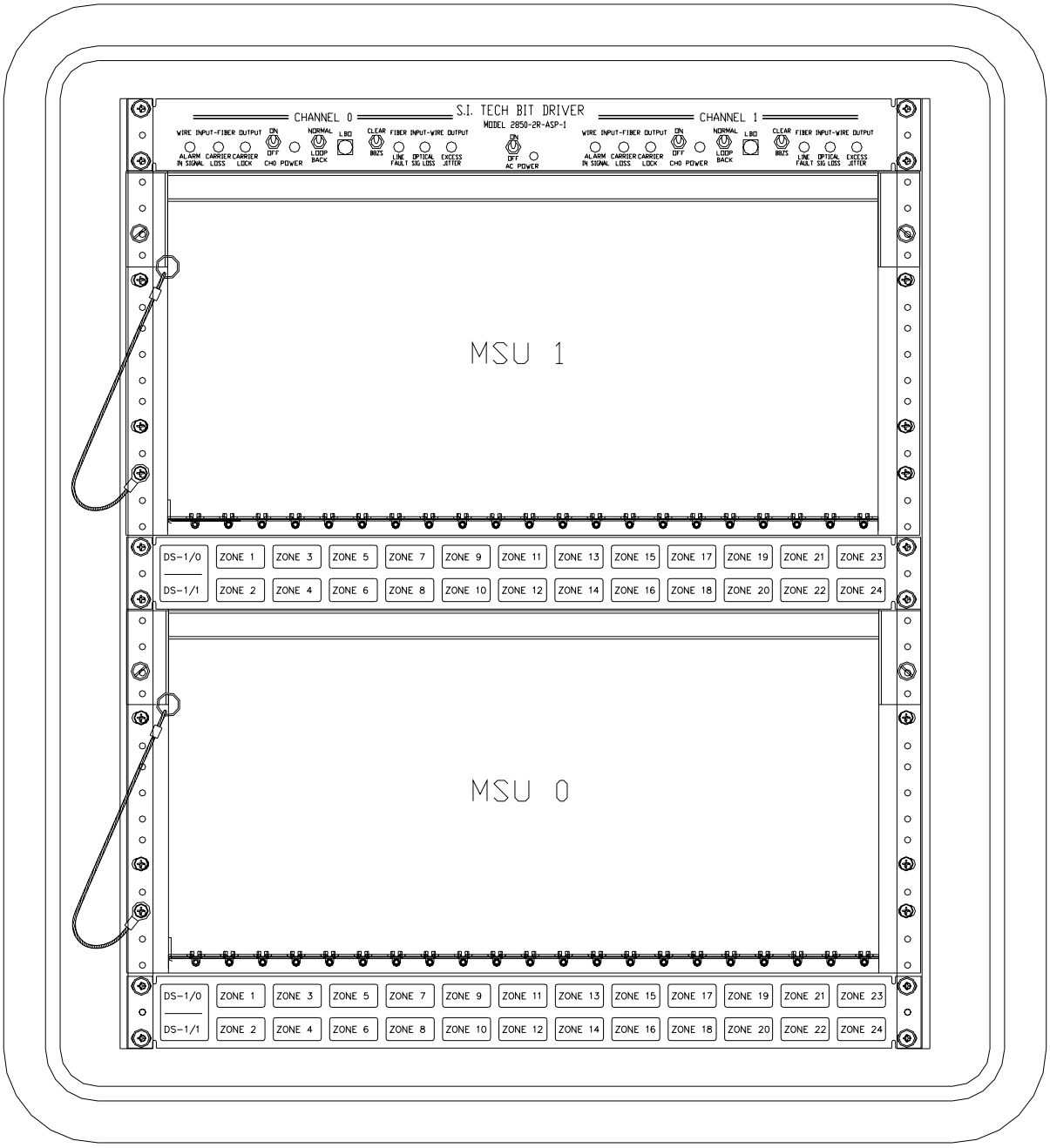
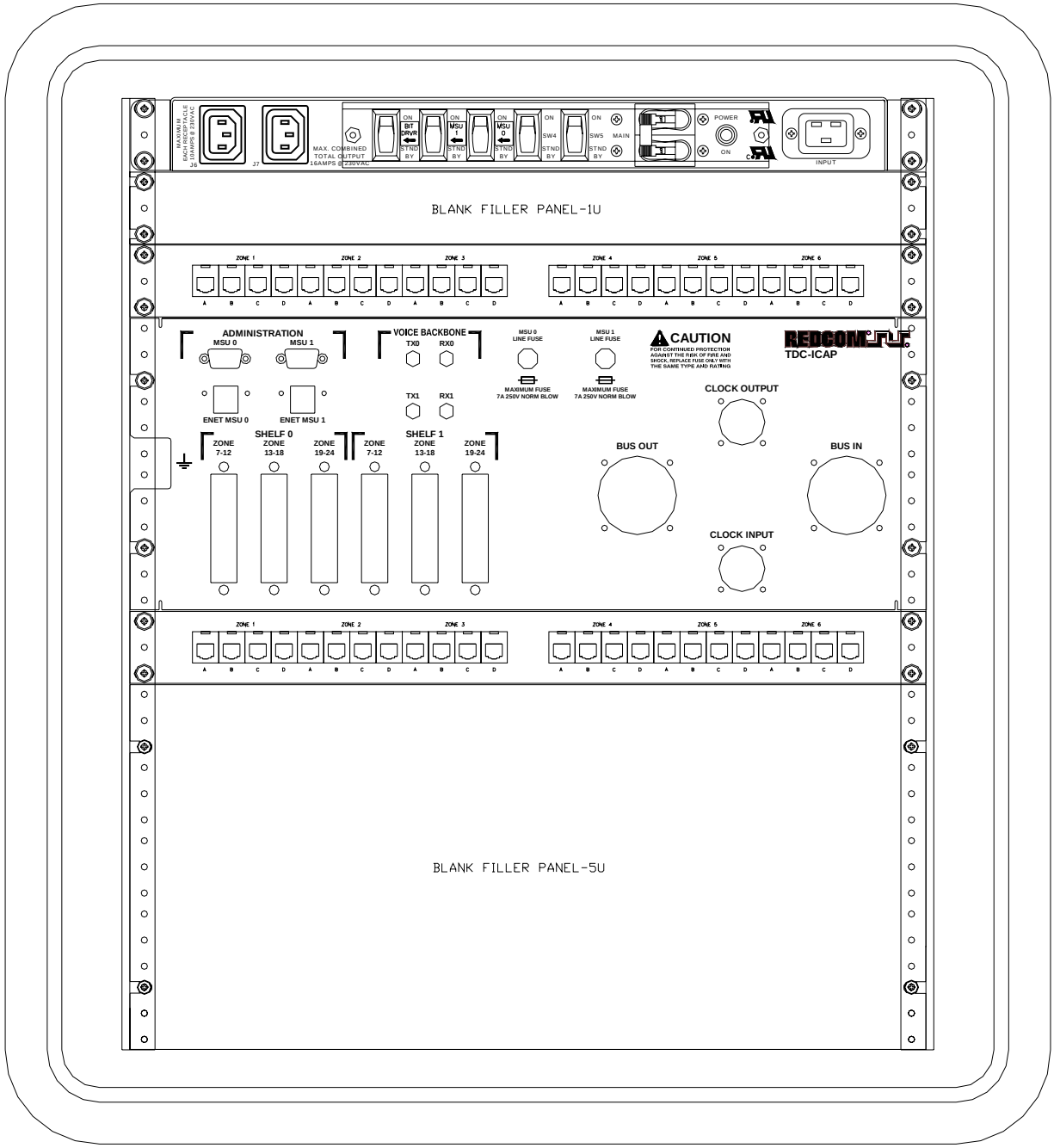


Figure 4: Large Voice Module Front Elevation Drawing

Figure 5 shows the rear elevation of the Large Voice Module**.**

Figure 5: Large Voice Module Rear Elevation Drawing



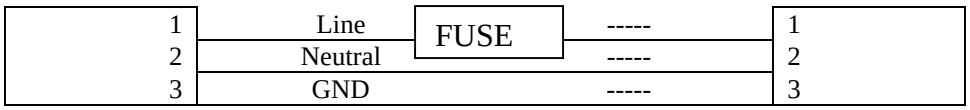
6.3 Cable Diagrams

Table 14: Cable Listing

Wire No.	Part Number	Manufacturer	Description
W2	CH9079-P36	REDCOM	Power Cable-A2 MSU0
W3	CH9079-P36	REDCOM	Power Cable-A2 MSU1
W5	90FB020101	REDCOM	Optic T1 Voice Backbone (0)
W6	90FB020101	REDCOM	Optic T1 Voice Backbone (1)
W8	CA9079-304	REDCOM	RS-232 Switch MSU0 Admin Cable
W9	CA9079-313	REDCOM	RS-232 Switch MSU1 Admin Cable
W11	CH9079-311	REDCOM	Remote Zone Cable
W12	CH9079-309		Remote Zone Cable
W13	CH9079-312		Remote Zone Cable
W14	CH9079-310		Remoter Zone Cable
	90DB9FMX10	REDCOM	Admin cable, Laptop to DF (stored in pouch)
	90FB640101	REDCOM	Inter-module fiber optic cable (stored in pouch)

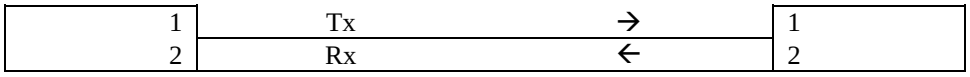
Cable W2&W3 (CH9079-P36)
Switch-A2 Power Cable
Pin Assignments

IEC-320 Receptacle Switch-A2 (MSU0/1) Power	IEC-320 Plug Power Distribution Unit- A5 Power



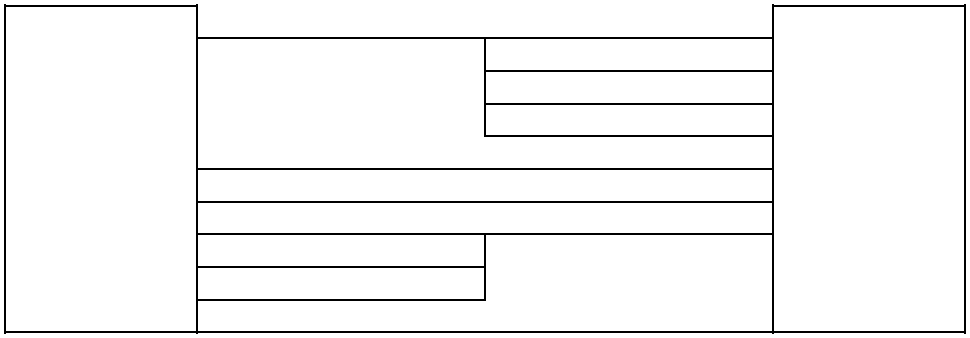
Cable W5&W6 (90FB020101)
Voice Backbone Fiber Optic Cable
Pin Assignments

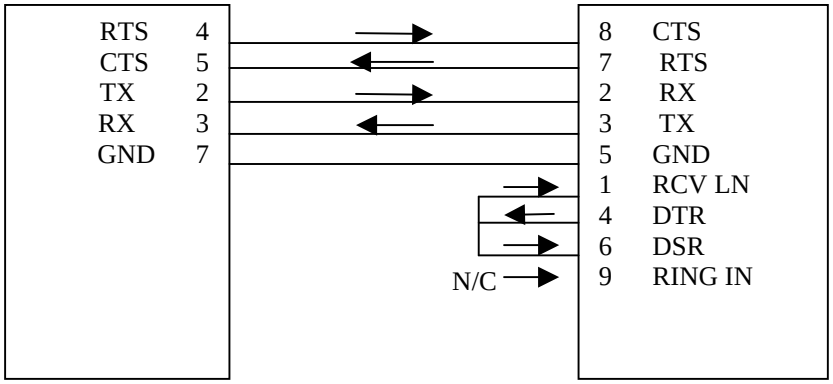
ST Plug Dual T1 FO Modem	ST Plug I/O DF I/O DF



Cable W8 (CA9079-304)
Switch MSU 0 Admin Cable
Pin Assignments

DB25 (MALE)	DB09F
Plug	Receptacle
AMP 745496-2	AMP 745491-2
Switch MSU 0	I/O DF
Admin Port	I/O DF J3

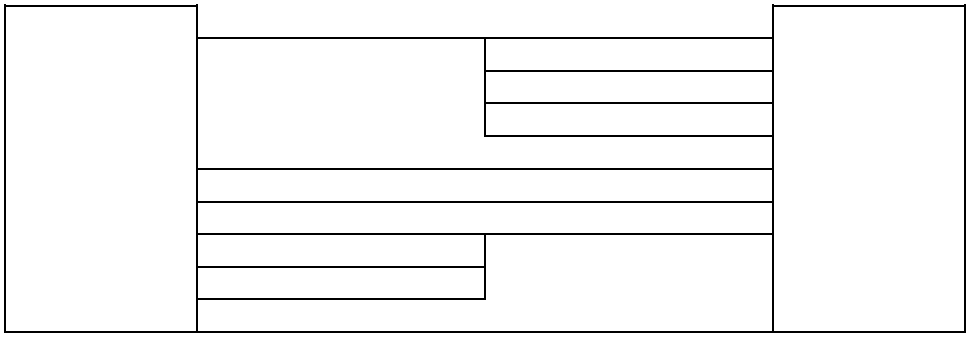


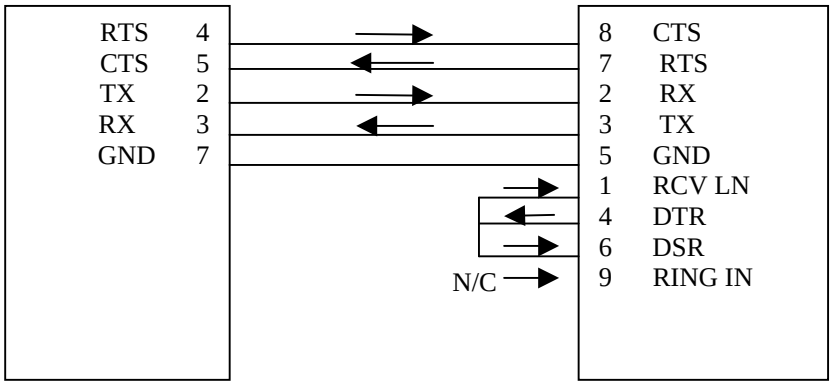


Signal	Direction

Cable W9 (CA9079-313)
Switch MSU 1 Admin Cable
Pin Assignments

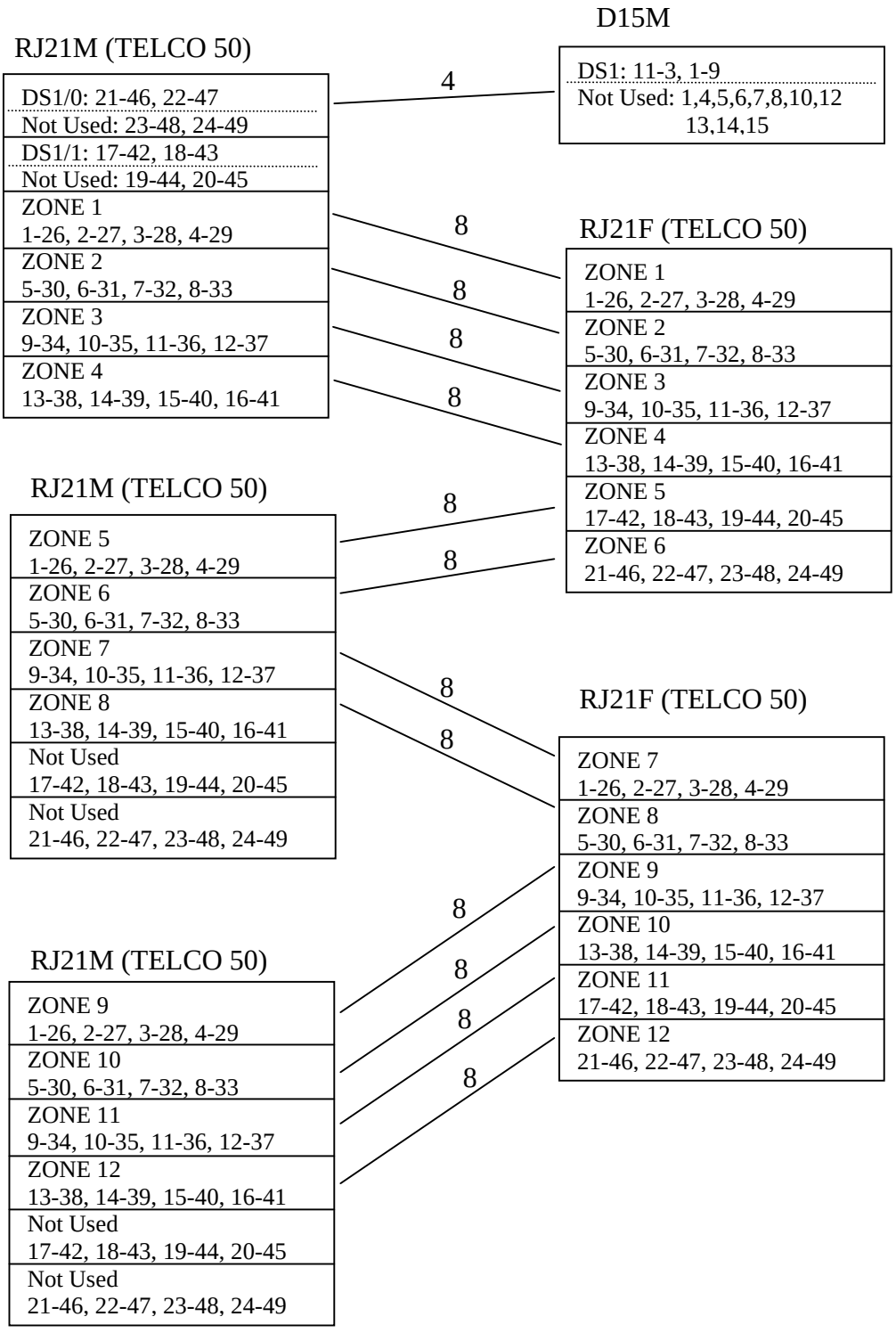
DB25 (MALE)	DB09F
Plug	Receptacle
AMP 745496-2	AMP 745491-2
Switch MSU 1	I/O DF
Admin Port J2	I/O DF J3



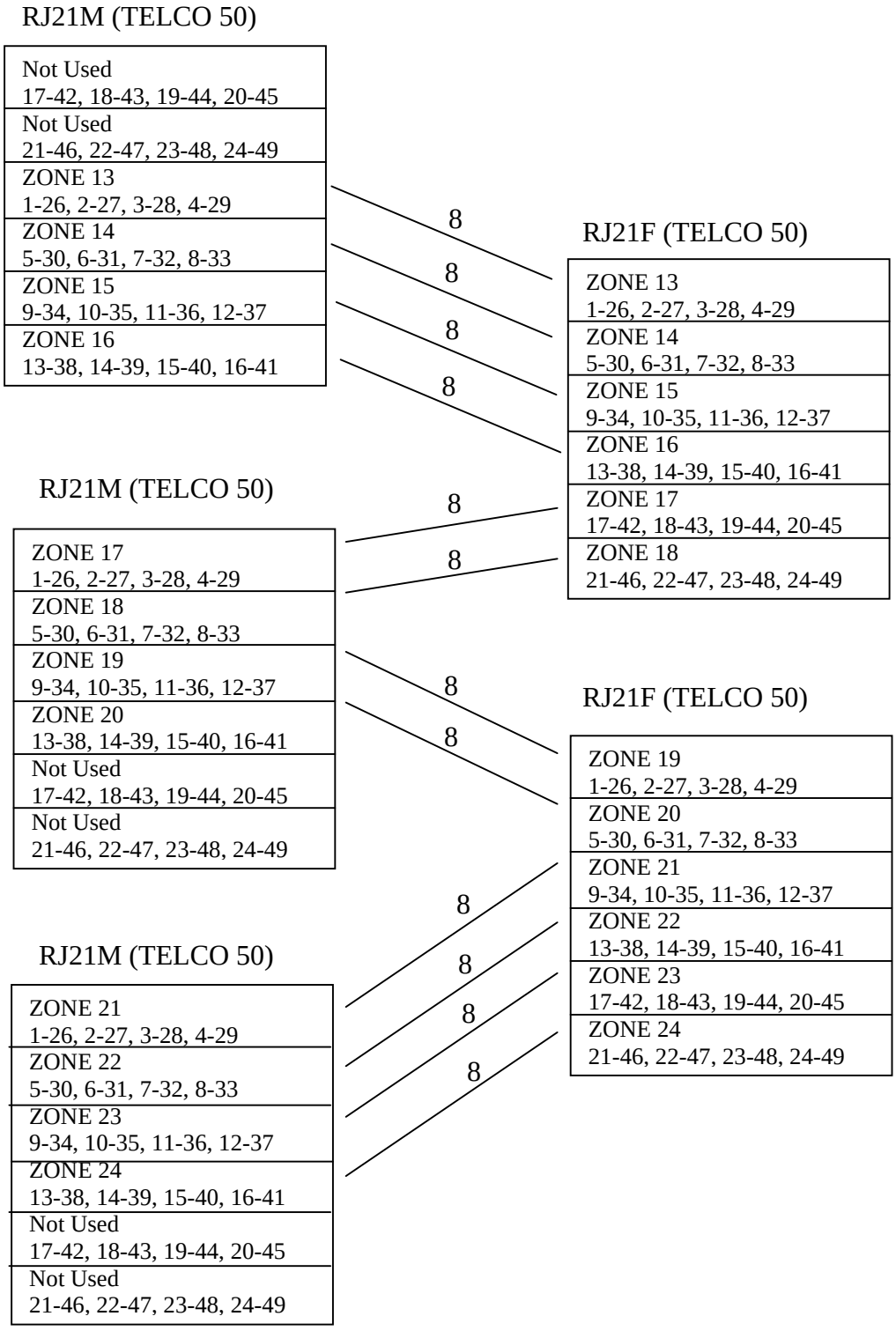


W11 (CH9079-311)

CABLE TRAY (0) I/O DF (0)

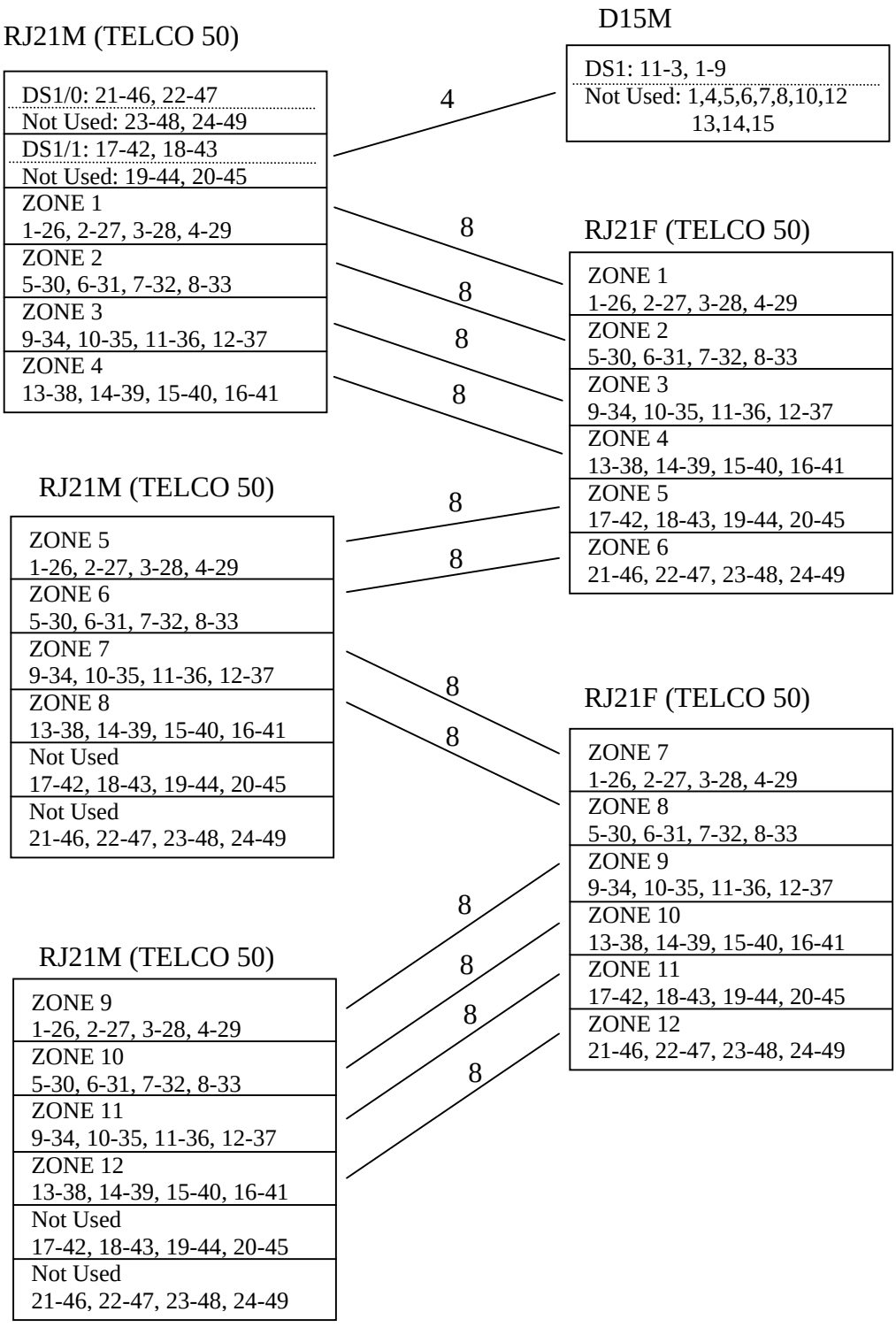


CABLE W12, W14 (CH9079-309 and CH9079-310)
CABLE TRAY (0) and (1) I/O DF



W13 (CH9079-312)

CABLE TRAY (1) I/O DF(1)



Cable 90DB9FMX10
Module Admin Cable (stored in pouch)
Pin Assignments

DB9F	DB9M
Receptacle	Plug
AMP 745491-2	AMP 745906-1
Laptop COM port	I/O DF
Terminal	Various Admin
DTE	

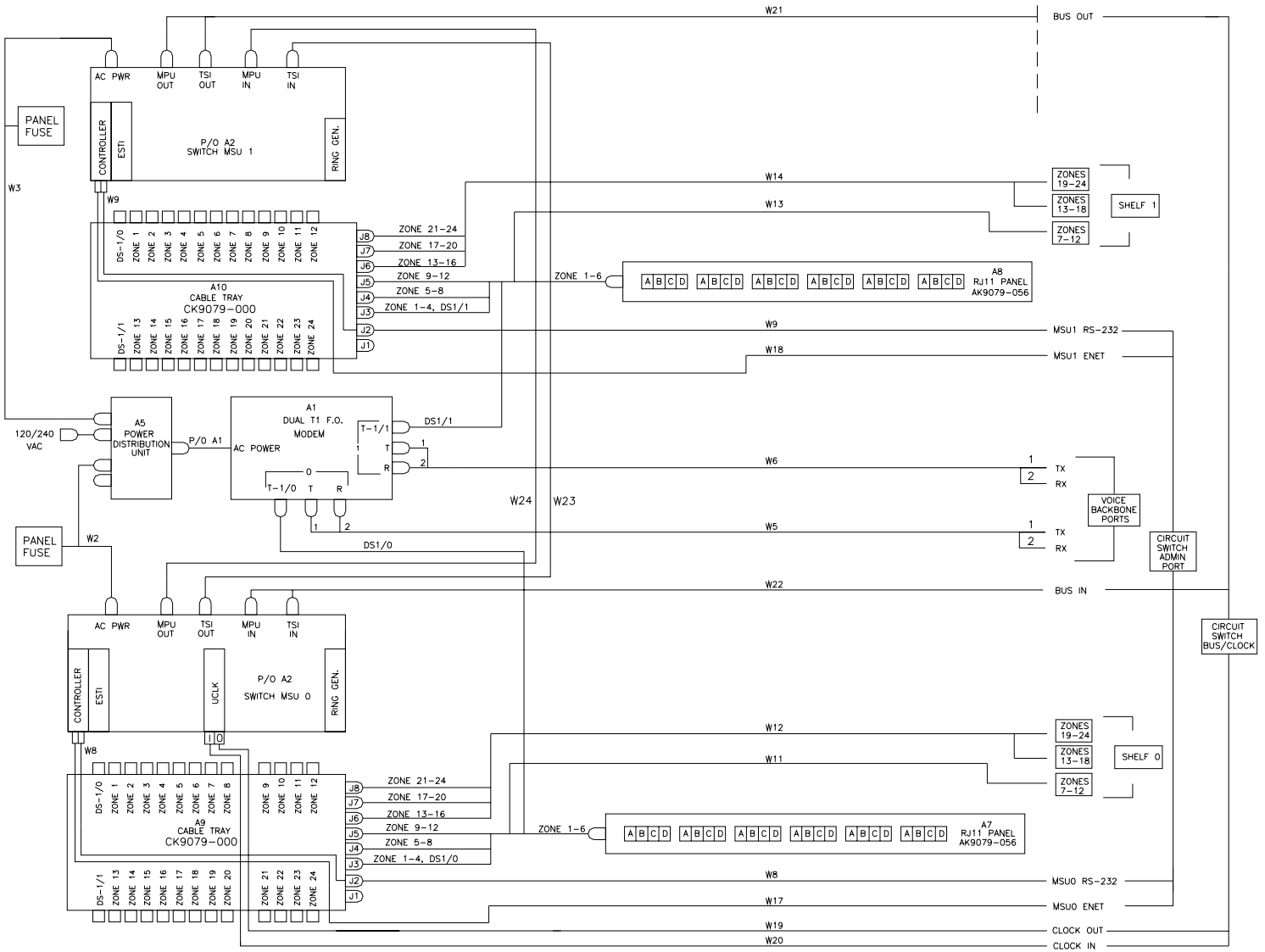
	Signal	Direction	
2	RD	←	2
3	TD	→	3
4	DTR	→	4
5	GND	----	5
6	DSR	←	6
7	RTS	→	7
8	CTS	←	8

Cable 90FB640101
Fiber Optic Backbone Cable (stored in pouch)
6 Meter length
Pin Assignments

ST	ST
Plug	Plug

	Signal	Direction	
1	Tx	→	1
2	Rx	←	2

6.4 Interconnection Diagram


W21
BUS OUT
AC PWR
MPU OUT
TSI OUT
MPU IN
TSI IN
PANEL FUSE
CONTROLLER
ESTI
P/O A2
SWITCH MSU 1
RING GEN.
W3
W9
DS-1/0
ZONE 1
ZONE 2
ZONE 3
ZONE 4
ZONE 5
ZONE 6
ZONE 7
ZONE 8
ZONE 9
ZONE 10
ZONE 11
ZONE 12
J8
J7
J6
J5
J4
J3
J2
J1
ZONE 21-24
ZONE 17-20
ZONE 13-16
ZONE 9-12
ZONE 5-8
ZONE 1-4, DS1/1
A10
CABLE TRAY
CK9079-000
DS-1/1
ZONE 13
ZONE 14
ZONE 15
ZONE 16
ZONE 17
ZONE 18
ZONE 19
ZONE 20
ZONE 21
ZONE 22
ZONE 23
ZONE 24
W14
W13
ZONES 19-24
ZONES 13-18
ZONES 7-12
SHELF 1
ZONE 1-6
A8
RJ11 PANEL
AK9079-056
A B C D
W9
MSU1 RS-232
W18
MSU1 ENET
120/240 VAC
A5
POWER DISTRIBUTION UNIT
P/O A1
A1
DUAL T1 F.O. MODEM
AC POWER
T-1/1
T-1/0
T
R
DS1/1
DS1/0
W6
W5
TX
RX
VOICE BACKBONE PORTS
CIRCUIT SWITCH ADMIN PORT
W24
W23
PANEL FUSE
W2
W22
BUS IN
CIRCUIT SWITCH BUS/CLOCK
UCLK
P/O A2
SWITCH MSU 0
W8
A9
CABLE TRAY
CK9079-000
W12
W11
A7
RJ11 PANEL
AK9079-056
W8
MSU0 RS-232
W17
MSU0 ENET
W19
CLOCK OUT
W20
CLOCK IN